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(54) CIRCUIT BOARD MATERIAL

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a circuit board material excellent in flatness, smoothness, electric insulating property, workability and chemical durability, having an appropriate coefft. of thermal expansion and useful for a circuit board for mounting a semiconductor, etc.

SOLUTION: The circuit board material comprises an alkali-free glass contg., by weight, 30-50% SiO_2, 1-10% B_2O_3, 1-10% Al_2O_3, 20-50% BaO, 0-20% SrO, 0-5% MgO and 0-15% CaO and preferably contg. at least one selected from ZnO, TiO_2, ZrO_2, Nb_2O_5, Sb_2O_3, SnO_2, La_2O_3, Bi_2O_3, Y_2O_3, and F as other component.

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CLAIMS

[Claim(s)]
[Claim 1] At weight %, it is SiO2. 30 - 50%, B-2 O3 1 - 10%, aluminum 2O3 1 - 10%, BaO 20 - 50%, SrO 0 - 20%, 0 - 5% of MgO(s), CaO Wiring substrate ingredient which consists of glass which contains 0 - 15% and does not contain an alkali component.
[Claim 2] Furthermore, the wiring substrate ingredient according to claim 1 which contains at least one sort chosen from ZnO, TiO2, ZrO2, Nb 2O5, Sb2O3, SnO2 and La 2O3, Bi2O3, Y2O3, and F as other components.
[Claim 3] At weight %, it is SiO2. 30 - 45%, B-2 O3 1 - 10%, aluminum 2O3 1 - 7%, BaO 22 - 35%, SrO 1 - 17%, MgO 0 - 5%, CaO 0 - 14%, ZnO 0 - 15%, TiO2 0 - 10%, ZrO2 0 - 10%, and La 2O3 Wiring substrate ingredient according to claim 2 which consists of glass which contains 0 - 10% and does not contain an alkali component.
[Claim 4] At weight %, it is SiO2. 35 - 40%, B-2 O3 1 - 5%, aluminum 2O3 1 - 5%, BaO 25 - 35%, SrO 1 - 10%, MgO 0 - 5%, CaO 1 - 10%, ZnO 0 - 15%, TiO2 0 - 7%, 20 - 7% of ZrO(s), La 2O3 Wiring substrate ingredient according to claim 3 which consists of glass which contains 1 - 7%, and the sum total content of TiO2 and ZrO2 is 1 - 7%, and does not contain an alkali component.
[Claim 5]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention has a suitable coefficient of thermal expansion, and relates to the wiring substrate for semi-conductor mounting etc. at a useful wiring substrate ingredient while it is excellent in surface smoothness, smooth nature, electric insulation, workability, and chemical durability in more detail about a wiring substrate ingredient.
[0002]
[Description of the Prior Art] As a substrate for semi-conductor mounting carrying semiconductor chips, such as IC and LSI, various things are proposed and a resin substrate, a ceramic substrate, etc. which are put in practical use, for example, are represented with a glass-epoxy resin printed circuit board are put in practical use. The demand to a substrate ingredient is also becoming severe with the densification of IC chip mounted, and improvement in the speed in recent years, and the demand especially to the surface smoothness of a substrate and smooth nature is high. If the irregularity on the front face of a substrate is large, when homogeneity cannot be wired in a ** pitch, in case IC chip is mounted, a projection interferes and the problem of being unable to carry out the bonding of the chip on the whole surface arises. This serves as a defect fatal to a flip chip package.
[0003] Drawing 1 is the front view of one example of IC chip mounting substrate currently laid in the mother board. As this drawing 1 shows, on the mother board 1, the substrate (wiring substrate) 2 with which wiring was formed is laid, and the solder bump 4 is fixed. And wiring and the IC chip 3 which were prepared in the wiring substrate 2 are connected by the solder bump 4, and the IC chip 3 is mounted. In addition, 5 is the wiring formation section.
[0004] Said ceramic substrate has field relative roughness and large curvature, and cost starts grinding too much the top where the constraint on an activity is large, and it is a problem also with the still more important consistency of a thermal expansion property. The glass-epoxy resin printed circuit board generally used on the other hand Even if it is going to mount IC chip with which a coefficient of thermal expansion becomes ** Li and this substrate from a coefficient-of-thermal-expansion abbreviation 34x10-7/degree C silicon crystal about 150-160x10-7/degree C Distortion remains for the chip after mounting, a crack enters at a bonding area, IC chip is destroyed further, or there is a possibility of inviting the situations which are not desirable, such as bonding separating and causing a faulty connection. Therefore, as for the wiring substrate soldered to a mother board after mounting a semi-conductor, what consists of an ingredient with the middle coefficient of thermal expansion of a silicon crystal and a glass-epoxy resin substrate, i.e., an about [70-100x10-7/degree C] coefficient of thermal expansion, is desirable in order to give the duty which eases the difference of the thermal expansion property of a semi-conductor and a mother board.
[0005]
[Problem(s) to be Solved by the Invention] This invention is the basis of such a situation, has a suitable coefficient of thermal expansion, and aims at providing the wiring substrate for semi-conductor mounting etc. with a useful wiring substrate ingredient while excelling in surface smoothness, smooth nature, electric insulation, workability, and chemical durability.
[0006]
[Means for Solving the Problem] As a result of repeating research wholeheartedly that this invention person should develop the wiring substrate ingredient which has the aforementioned desirable property, the wiring substrate ingredient which consists of glass which has a specific presentation came to complete this invention for that object being suited based on a header and this knowledge.
[0007] Namely, this invention is weight % and is SiO2. 30 - 50%, B-2 O3 1 - 10%, aluminum 2O3 1 - 10%, BaO 20 - 50%, SrO 0 - 20%, MgO 0 - 5%, and CaO As the wiring substrate ingredient which consists of glass which contains 0 - 15% and does not contain an alkali component, and a component of further others The wiring substrate ingredient which consists of glass which contains at least one sort chosen from ZnO, TiO2, ZrO2, Nb 2O5, Sb2O3, SnO2 and La 2O3, Bi2O3, Y2O3, and F, and does not contain an alkali component is offered.
[0008]
[Embodiment of the Invention] The glass used for the wiring substrate ingredient of this invention is alkali free glass with the middle thermal expansion property of a silicon crystal and a glass-epoxy resin substrate. The glass with the middle thermal expansion property of a silicon crystal and a glass-epoxy resin substrate has an about [70-100x10-7/degree C] coefficient of thermal expansion, and its glass containing alkali which is represented by soda lime glass is common as such glass. However, when the alkali component is included, there is a possibility of an alkali component being eluted from a glass substrate and doing breakage to a semiconductor chip. Therefore, alkali free glass is used, moreover, this glass has the high transition point into the wiring substrate ingredient of this invention, and what it is hard to transform by high temperature processing, such as plating in the manufacture process of a wiring substrate, vacuum evaporationo, sputtering, and soldering, is required of it.
[0009] However, since it is generally known that it is low thermal expansion so that it may be represented by the glass for thin film transistor (TFT) liquid crystal display panels, and the top alkali component lowers melting temperature or is effective in lowering liquid phase temperature, alkali free glass is also the component which makes melting of glass easy.
[0010] The glass used by this invention has a high temperature expansion coefficient and the high transition point, and, moreover, is alkali free glass with easy melting. In the glass used by this invention, SiO2 is an indispensable component for making the frame of glass. Therefore, if SiO2 becomes less than 30% of the weight, the liquid phase temperature of glass will rise. Moreover, if SiO2 exceeds 50 % of the weight, a coefficient of thermal expansion will become small. Therefore, the content of SiO2 is limited to 30 - 50% of the weight. The desirable content of SiO2 is 30 - 45 % of the weight, and a still more desirable content is 35 - 40 % of the

weight.

[0011] B-2 O3 is an indispensable component which is effective in lowering liquid phase temperature by adding to silicate glass. Therefore, if B-2 O3 becomes less than 1% of the weight, liquid phase temperature will rise and it will be hard coming to vitrify. Moreover, if it exceeds 10 % of the weight, a coefficient of thermal expansion will become small. Therefore, the content of B-2 O3 is limited to 1 - 10% of the weight. The content of desirable B-2 O3 is 1 - 5% of the weight of the range.

[0012] aluminum 2O3 is a component which has the effectiveness of raising the chemical durability of glass, and the effectiveness of lowering liquid phase temperature, and is indispensable to this invention. Therefore, if aluminum 2O3 becomes less than 1% of the weight, chemical durability will get worse and liquid phase temperature will rise. Moreover, if it exceeds 10 % of the weight, a coefficient of thermal expansion will become small. Therefore, the content of aluminum 2O3 is limited to 1 - 10% of the weight. The content of desirable aluminum 2O3 is 1 - 7 % of the weight, and a still more desirable content is 1 - 5 % of the weight.

[0013] BaO is a component which has the effectiveness of lowering the liquid phase temperature of glass by optimum dose addition, and is indispensable to this invention. When BaO exceeds less than 20 % of the weight or 50 % of the weight, liquid phase temperature rises. Therefore, the content of BaO is limited to 20 - 50% of the weight. The desirable content of BaO is 22 - 35 % of the weight, and a still more desirable content is 25 - 35 % of the weight.

[0014] SrO is an arbitration component which has the effectiveness of lowering the liquid phase temperature of glass by optimum dose addition. When SrO exceeds 20 % of the weight, liquid phase temperature rises. Therefore, the content of SrO is limited to 0 - 20% of the weight. The desirable content of SrO is 1 - 17 % of the weight, and a still more desirable content is 1 - 10 % of the weight.

[0015] MgOCaO has the effectiveness of lowering a lowering coefficient of thermal expansion for the liquid phase temperature of glass by optimum dose addition, and is the addition component of arbitration in this invention. If MgO exceeds 5 % of the weight and CaO exceeds 15 % of the weight, liquid phase temperature will rise. Therefore, the content of CaO is limited for the content of MgO to 0 - 15% of the weight zero to 5% of the weight. The desirable content of CaO is 1 - 14 % of the weight, and a still more desirable content is 1 - 10 % of the weight.

[0016] In the glass used by this invention as a component of further others ZnO, At least one sort chosen from TiO2, ZrO2, Nb 2O5, Sb2O3, SnO2 and La 2O3, Bi2O3, Y2O3, P2O5, and F You may add in the range in which the object of this invention is not spoiled for adjustment of lowering of liquid phase temperature, improvement in chemical durability, founding, and a coefficient of thermal expansion etc. In these components, ZnO, TiO2, ZrO2, and La 2O3 are especially suitable.

[0017] ZnO is a component which raises lowering and chemical durability, and can add liquid phase temperature to arbitration. However, if ZnO exceeds 15 % of the weight, a coefficient of thermal expansion will become low too much. Therefore, the content of ZnO is limited to 0 - 15% of the weight.

[0018] TiO2 and ZrO2 have the effectiveness of raising chemical durability, and they can add it to arbitration. However, if the content of TiO2 or ZrO2 exceeds 10 % of the weight, devitrification-proof nature will get worse. Therefore, the content of TiO2 and ZrO2 is limited to 0 - 10% of the weight, respectively. The desirable content of TiO2 and ZrO2 is 0 - 7 % of the weight, respectively. Moreover, it will become easy to devitrify, if the improvement effectiveness of chemical durability is not fully demonstrated at less than 1 % of the weight and the sum total content of TiO2 and ZrO2 exceeds 7 % of the weight. Therefore, the sum total content of TiO2 and ZrO2 has 1 - 7 desirable % of the weight.

[0019] La 2O3 has the effectiveness of lowering liquid phase temperature, and can add it to arbitration. However, if the content of La 2O3 exceeds 10 % of the weight, liquid phase temperature will rise conversely. Therefore, the content of La 2O3 is limited to 0 - 10% of the weight. The desirable content of La 2O3 is 1 - 7 % of the weight.

[0020] As explained above, the desirable thing of the glass used by this invention At weight %, it is SiO2. 30 - 45%, B-2 O3 1 - 10%, aluminum 2O3 1 - 7%, BaO 22 - 35%, SrO 1 - 17%, MgO 0 - 5%, CaO 1 - 14%, ZnO 0 - 15%, TiO2 0 - 10%, ZrO2 It is alkali free glass containing 0 - 10%, and 2O30 - 10% of La(s), and a still more desirable thing is weight %. SiO2 35 - 40%, B-2 O3 1 - 5%, aluminum 2O3 1 - 5%, BaO 25 - 35%, SrO 1 - 10%, MgO 0 - 5%, CaO 1 - 10%, 0 - 15% of ZnO(s), TiO2 0 - 7%, ZrO2 0 - 7%, and La 2O3 1 - 7% is contained and it is alkali free glass whose sum total content of TiO2 and ZrO2 is 1 - 7%.

[0021] The wiring substrate ingredient which consists of glass of such a presentation is excellent in surface smoothness, smooth nature, electric insulation, and chemical durability, and has the about [70-100x10-7/degree C] coefficient of thermal expansion the top where melting temperature is low and workability is also good. There is especially no limit as the production approach of the glass used as the wiring substrate ingredient of this invention, and the approach used commonly conventionally can be used. For example, using a hydroxide, a carbonate, a nitrate, an oxide, a sulfide, a chloride, etc. suitably as raw materials for glass, weighing capacity is carried out, and it mixes and considers as a mixing raw material so that it may become a desired presentation. This is put into heat-resistant crucible and it fuses at the temperature of about 1200-1500 degrees C, and stirring and after carrying out founding, it slushes into the mold of a request configuration and homogeneous glass is obtained by cooling slowly.

[0022] Especially a limit does not have the glass processing approach, either and the approach used commonly conventionally can be used. For example, after slicing the obtained glass block and making it the shape of sheet metal, the substrate excellent in surface smoothness is producible by wrapping or polishing both sides. It becomes a wiring substrate for semi-conductor mounting by using technique, such as plating, vacuum evaporationo, sputtering, etching, and photolithography, for this substrate, and forming wiring. Moreover, a hole can be made in a glass substrate by approaches, such as etching, sandblasting, ultrasonic machining, and laser beam machining, a metal can be embedded there, and a single phase wiring substrate with a multilayer-interconnection substrate or a beer hall can also be produced by forming a bonding pad and wiring.

[0023]

[Example] Next, although an example explains this invention to a detail further, this invention is not limited at all by these examples.

[0024] The glass of the presentation shown in one to example 7 table 1 and a table 2 was fused, the slip casting was carried out into the iron frame, and the glass block was produced by cooling slowly to a room temperature. The obtained glass block was processed into tabular [of 100x100x1.0mm] through cutting, a slice, and polish. The coefficient of thermal expansion, the glass transition point, and field relative roughness (Ra) of this glass substrate were measured. In addition, while measuring the coefficient of thermal expansion and the glass transition point based on Japanese optical glass Semiconductor Equipment & Materials International specification JOGIS-1975, field relative roughness was measured with the contact process surface roughness plan. A result is shown in a table 1 and a table 2.

[0025]

[A table 1]

表1

		実施例1	実施例2	実施例3	実施例4
ガラス組成（重量%）	SiO_2	35.0	38.0	32.0	36.0
	B_2O_3	3.0	3.0	8.0	3.0
	Al_2O_3	3.0	3.0	3.0	3.0
	BaO	27.0	32.0	30.0	32.0
	SrO	14.0	12.0	5.0	3.0
	CaO	6.5	0.0	2.0	10.0
	MgO	2.0	3.0	0.0	3.0
	La_2O_3	4.0	5.0	10.0	5.0
	ZrO_2	5.0	4.0	3.0	5.0
	TiO_2	0.0	0.0	0.0	0.0
	ZrO_2+TiO_2	5.0	4.0	3.0	5.0
	ZnO	0.0	0.0	7.0	0.0
	Sb_2O_3	0.5	0.0	0.0	0.0
特性	熱膨張係数 ($\times 10^{-7}$/℃)	87	80	82	84
	ガラス転移点(℃)	695	685	655	675
	面粗度(Ra) (nm)	<10	<10	<10	<10

[0026]
[A table 2]

表2

		実施例5	実施例6	実施例7
ガラス組成（重量%）	SiO_2	43.0	37.0	39.0
	B_2O_3	4.0	3.0	2.0
	Al_2O_3	5.0	2.0	4.0
	BaO	33.0	30.0	31.0
	SrO	10.0	5.0	8.0
	CaO	6.0	8.0	4.0
	MgO	0.0	3.5	2.0
	La_2O_3	0.0	5.0	4.0
	ZrO_2	0.0	3.0	2.0
	TiO_2	0.0	2.0	2.0
	ZrO_2+TiO_2	0.0	5.0	4.0
	ZnO	0.0	1.0	2.0
	Sb_2O_3	0.0	0.5	0.0
特性	熱膨張係数 ($\times 10^{-7}$/℃)	82	84	81
	ガラス転移点(℃)	670	730	740
	面粗度(Ra) (nm)	<10	<10	<10

[0027] The glass of the presentation shown in the example 1 of a comparison and two table 3 was fused, the glass substrate was produced like examples 1-7, and a coefficient of thermal expansion, a glass transition point, and field relative roughness (Ra) were measured. The result is shown in a table 3.
[0028] The coefficient of thermal expansion, the glass transition point, and field relative roughness (Ra) of the example 3 of a comparison, the alumina ceramic substrate (example 3 of a comparison) of 4 marketing, and a commercial glass-epoxy resin

substrate (example 4 of a comparison) were measured like examples 1-7. The result is shown in a table 3.
[0029]
[A table 3]

表3

		比較例1	比較例2	比較例3	比較例4
ガラス組成（重量%）	SiO_2	52.8	65.0	アルミナセラミック	ガラスーエポキシ樹脂
	B_2O_3	6.7	18.0		
	Al_2O_3	22.0	8.4		
	BaO	0.0	3.1		
	SrO	0.0	0.0		
	CaO	0.0	5.5		
	MgO	14.7	0.0		
	La_2O_3	0.0	0.0		
	ZrO_2	0.0	0.0		
	ZnO	2.5	0.0		
	Sb_2O_3	1.3	0.0		
特性	熱膨張係数 ($\times10^{-7}$/℃)	34	45	70	150
	ガラス転移点(℃)	760	480	—	<250
	面粗度(Ra)(nm)	<10	<10	700	200

[0030] As shown in tables 1 and 2, a coefficient of thermal expansion is 80 - 90x10-7/degree C, and the field relative roughness (Ra) of each glass substrate of examples 1-7 is less than 10nm. As shown in a table 3 on the other hand, the glass substrate of the examples 1 and 2 of a comparison has a coefficient of thermal expansion as low as 30 - 50x10-7/degree C. Each of alumina ceramic substrates of the examples 3 and 4 of a comparison and glass-epoxy resin substrates has still larger field granularity. Moreover, a glass-epoxy resin substrate has a large coefficient of thermal expansion the top where a glass transition point is low.
[0031]
[Effect of the Invention] A coefficient of thermal expansion is about 70-100x10-7/degree C, and is useful to the wiring substrate for semi-conductor mounting etc. while the wiring substrate ingredient of this invention is excellent in surface smoothness, smooth nature, electric insulation, workability, and chemical durability.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention has a suitable coefficient of thermal expansion, and relates to the wiring substrate for semi-conductor mounting etc. at a useful wiring substrate ingredient while it is excellent in surface smoothness, smooth nature, electric insulation, workability, and chemical durability in more detail about a wiring substrate ingredient.

[Translation done.]

PRIOR ART

[Description of the Prior Art] As a substrate for semi-conductor mounting carrying semiconductor chips, such as IC and LSI, various things are proposed and a resin substrate, a ceramic substrate, etc. which are put in practical use, for example, are represented with a glass-epoxy resin printed circuit board are put in practical use. The demand to a substrate ingredient is also becoming severe with the densification of IC chip mounted, and improvement in the speed in recent years, and the demand especially to the surface smoothness of a substrate and smooth nature is high. If the irregularity on the front face of a substrate is large, when homogeneity cannot be wired in a ** pitch, in case IC chip is mounted, a projection interferes and the problem of being unable to carry out the bonding of the chip on the whole surface arises. This serves as a defect fatal to a flip chip package.
[0003] Drawing 1 is the front view of one example of IC chip mounting substrate currently laid in the mother board. As this drawing 1 shows, on the mother board 1, the substrate (wiring substrate) 2 with which wiring was formed is laid, and the solder bump 4 is fixed. And wiring and the IC chip 3 which were prepared in the wiring substrate 2 are connected by the solder bump 4, and the IC chip 3 is mounted. In addition, 5 is the wiring formation section.
[0004] Said ceramic substrate has field relative roughness and large curvature, and cost starts grinding too much the top where the constraint on an activity is large, and it is a problem also with the still more important consistency of a thermal expansion property. The glass-epoxy resin printed circuit board generally used on the other hand Even if it is going to mount IC chip with which a coefficient of thermal expansion becomes ** Li and this substrate from a coefficient-of-thermal-expansion abbreviation 34x10-7/degree C silicon crystal about 150-160x10-7/degree C Distortion remains for the chip after mounting, a crack enters at a bonding area, IC chip is destroyed further, or there is a possibility of inviting the situations which are not desirable, such as bonding separating and causing a faulty connection. Therefore, as for the wiring substrate soldered to a mother board after mounting a semi-conductor, what consists of an ingredient with the middle coefficient of thermal expansion of a silicon crystal and a glass-epoxy resin substrate, i.e., an about [70-100x10-7/degree C] coefficient of thermal expansion, is desirable in order to give the duty which eases the difference of the thermal expansion property of a semi-conductor and a mother board.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] A coefficient of thermal expansion is about 70-100x10-7/degree C, and is useful to the wiring substrate for semi-conductor mounting etc. while the wiring substrate ingredient of this invention is excellent in surface smoothness, smooth nature, electric insulation, workability, and chemical durability.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention is the basis of such a situation, has a suitable coefficient of thermal expansion, and aims at providing the wiring substrate for semi-conductor mounting etc. with a useful wiring substrate ingredient while excelling in surface smoothness, smooth nature, electric insulation, workability, and chemical durability.

[Translation done.]

MEANS

[Means for Solving the Problem] As a result of repeating research wholeheartedly that this invention person should develop the wiring substrate ingredient which has the aforementioned desirable property, the wiring substrate ingredient which consists of glass which has a specific presentation came to complete this invention for that object being suited based on a header and this knowledge.
[0007] Namely, this invention is weight % and is SiO2. 30 – 50%, B-2 O3 1 – 10%, aluminum 2O3 1 – 10%, BaO 20 – 50%, SrO 0 – 20%, MgO 0 – 5%, and CaO As the wiring substrate ingredient which consists of glass which contains 0 – 15% and does not contain an alkali component, and a component of further others The wiring substrate ingredient which consists of glass which contains at least one sort chosen from ZnO, TiO2, ZrO2, Nb 2O5, Sb2O3, SnO2 and La 2O3, Bi2O3, Y2O3, and F, and does not contain an alkali component is offered.
[0008]
[Embodiment of the Invention] The glass used for the wiring substrate ingredient of this invention is alkali free glass with the middle thermal expansion property of a silicon crystal and a glass-epoxy resin substrate. The glass with the middle thermal expansion property of a silicon crystal and a glass-epoxy resin substrate has an about [70-100x10-7/degree C] coefficient of thermal expansion, and its glass containing alkali which is represented by soda lime glass is common as such glass. However, when the alkali component is included, there is a possibility of an alkali component being eluted from a glass substrate and doing breakage to a semiconductor chip. Therefore, alkali free glass is used, moreover, this glass has the high transition point into the wiring substrate ingredient of this invention, and what it is hard to transform by high temperature processing, such as plating in the manufacture process of a wiring substrate, vacuum evaporationo, sputtering, and soldering, is required of it.
[0009] However, since it is generally known that it is low thermal expansion so that it may be represented by the glass for thin film transistor (TFT) liquid crystal display panels, and the top alkali component lowers melting temperature or is effective in lowering liquid phase temperature, alkali free glass is also the component which makes melting of glass easy.
[0010] The glass used by this invention has a high temperature expansion coefficient and the high transition point, and, moreover, is alkali free glass with easy melting. In the glass used by this invention, SiO2 is an indispensable component for making the frame of glass. Therefore, if SiO2 becomes less than 30% of the weight, the liquid phase temperature of glass will rise. Moreover, if SiO2 exceeds 50 % of the weight, a coefficient of thermal expansion will become small. Therefore, the content of SiO2 is limited to 30 – 50% of the weight. The desirable content of SiO2 is 30 – 45 % of the weight, and a still more desirable content is 35 – 40 % of the weight.
[0011] B-2 O3 is an indispensable component which is effective in lowering liquid phase temperature by adding to silicate glass. Therefore, if B-2 O3 becomes less than 1% of the weight, liquid phase temperature will rise and it will be hard coming to vitrify. Moreover, if it exceeds 10 % of the weight, a coefficient of thermal expansion will become small. Therefore, the content of B-2 O3 is limited to 1 – 10% of the weight. The content of desirable B-2 O3 is 1 – 5% of the weight of the range.
[0012] aluminum 2O3 is a component which has the effectiveness of raising the chemical durability of glass, and the effectiveness of lowering liquid phase temperature, and is indispensable to this invention. Therefore, if aluminum 2O3 becomes less than 1% of the weight, chemical durability will get worse and liquid phase temperature will rise. Moreover, if it exceeds 10 % of the weight, a coefficient of thermal expansion will become small. Therefore, the content of aluminum 2O3 is limited to 1 – 10% of the weight. The content of desirable aluminum 2O3 is 1 – 7 % of the weight, and a still more desirable content is 1 – 5 % of the weight.
[0013] BaO is a component which has the effectiveness of lowering the liquid phase temperature of glass by optimum dose addition, and is indispensable to this invention. When BaO exceeds less than 20 % of the weight or 50 % of the weight, liquid phase temperature rises. Therefore, the content of BaO is limited to 20 – 50% of the weight. The desirable content of BaO is 22 – 35 % of the weight, and a still more desirable content is 25 – 35 % of the weight.
[0014] SrO is an arbitration component which has the effectiveness of lowering the liquid phase temperature of glass by optimum dose addition. When SrO exceeds 20 % of the weight, liquid phase temperature rises. Therefore, the content of SrO is limited to 0 – 20% of the weight. The desirable content of SrO is 1 – 17 % of the weight, and a still more desirable content is 1 – 10 % of the weight.
[0015] MgOCaO has the effectiveness of lowering a lowering coefficient of thermal expansion for the liquid phase temperature of glass by optimum dose addition, and is the addition component of arbitration in this invention. If MgO exceeds 5 % of the weight and CaO exceeds 15 % of the weight, liquid phase temperature will rise. Therefore, the content of CaO is limited for the content of MgO to 0 – 15% of the weight zero to 5% of the weight. The desirable content of CaO is 1 – 14 % of the weight, and a still more desirable content is 1 – 10 % of the weight.
[0016] In the glass used by this invention as a component of further others ZnO, At least one sort chosen from TiO2, ZrO2, Nb 2O5, Sb2</SUB>O3, SnO2 and La 2O3, Bi2O3, Y2O3, P2O5, and F You may add in the range in which the object of this invention is not spoiled for adjustment of lowering of liquid phase temperature, improvement in chemical durability, founding, and a coefficient of thermal expansion etc. In these components, ZnO, TiO2, ZrO2, and La 2O3 are especially suitable.
[0017] ZnO is a component which raises lowering and chemical durability, and can add liquid phase temperature to arbitration. However, if ZnO exceeds 15 % of the weight, a coefficient of thermal expansion will become low too much. Therefore, the content of ZnO is limited to 0 – 15% of the weight.
[0018] TiO2 and ZrO2 have the effectiveness of raising chemical durability, and they can add it to arbitration. However, if the content of TiO2 or ZrO2 exceeds 10 % of the weight, devitrification-proof nature will get worse. Therefore, the content of TiO2 and

ZrO_2 is limited to 0 – 10% of the weight, respectively. The desirable content of TiO_2 and ZrO_2 is 0 – 7 % of the weight, respectively. Moreover, it will become easy to devitrify, if the improvement effectiveness of chemical durability is not fully demonstrated at less than 1 % of the weight and the sum total content of TiO_2 and ZrO_2 exceeds 7 % of the weight. Therefore, the sum total content of TiO_2 and ZrO_2 has 1 – 7 desirable % of the weight.

[0019] La 2O3 has the effectiveness of lowering liquid phase temperature, and can add it to arbitration. However, if the content of La 2O3 exceeds 10 % of the weight, liquid phase temperature will rise conversely. Therefore, the content of La 2O3 is limited to 0 – 10% of the weight. The desirable content of La 2O3 is 1 – 7 % of the weight.

[0020] As explained above, the desirable thing of the glass used by this invention At weight %, it is SiO2. 30 – 45%, B-2 O3 1 – 10%, aluminum 2O3 1 – 7%, BaO 22 – 35%, SrO 1 – 17%, MgO 0 – 5%, CaO 1 – 14%, ZnO 0 – 15%, TiO2 0 – 10%, ZrO2 It is alkali free glass containing 0 – 10%, and 2O30 – 10% of La(s), and a still more desirable thing is weight %. SiO2 35 – 40%, B-2 O3 1 – 5%, aluminum 2O3 1 – 5%, BaO 25 – 35%, SrO 1 – 10%, MgO 0 – 5%, CaO 1 – 10%, 0 – 15% of ZnO(s), TiO2 0 – 7%, ZrO2 0 – 7%, and La 2O3 1 – 7% is contained and it is alkali free glass whose sum total content of TiO2 and ZrO2 is 1 – 7%.

[0021] The wiring substrate ingredient which consists of glass of such a presentation is excellent in surface smoothness, smooth nature, electric insulation, and chemical durability, and has the about [70-100x10-7/degree C] coefficient of thermal expansion the top where melting temperature is low and workability is also good. There is especially no limit as the production approach of the glass used as the wiring substrate ingredient of this invention, and the approach used commonly conventionally can be used. For example, using a hydroxide, a carbonate, a nitrate, an oxide, a sulfide, a chloride, etc. suitably as raw materials for glass, weighing capacity is carried out, and it mixes and considers as a mixing raw material so that it may become a desired presentation. This is put into heat-resistant crucible and it fuses at the temperature of about 1200-1500 degrees C, and stirring and after carrying out founding, it slushes into the mold of a request configuration and homogeneous glass is obtained by cooling slowly.

[0022] Especially a limit does not have the glass processing approach, either and the approach used commonly conventionally can be used. For example, after slicing the obtained glass block and making it the shape of sheet metal, the substrate excellent in surface smoothness is producible by wrapping or polishing both sides. It becomes a wiring substrate for semi-conductor mounting by using technique, such as plating, vacuum evaporationo, sputtering, etching, and photolithography, for this substrate, and forming wiring. Moreover, a hole can be made in a glass substrate by approaches, such as etching, sandblasting, ultrasonic machining, and laser beam machining, a metal can be embedded there, and a single phase wiring substrate with a multilayer-interconnection substrate or a beer hall can also be produced by forming a bonding pad and wiring.

[Translation done.]

EXAMPLE

[Example] Next, although an example explains this invention to a detail further, this invention is not limited at all by these examples.

[0024] The glass of the presentation shown in one to example 7 table 1 and a table 2 was fused, the slip casting was carried out into the iron frame, and the glass block was produced by cooling slowly to a room temperature. The obtained glass block was processed into tabular [of 100x100x1.0mm] through cutting, a slice, and polish. The coefficient of thermal expansion, the glass transition point, and field relative roughness (Ra) of this glass substrate were measured. In addition, while measuring the coefficient of thermal expansion and the glass transition point based on Japanese optical glass Semiconductor Equipment & Materials International specification JOGIS-1975, field relative roughness was measured with the contact process surface roughness plan. A result is shown in a table 1 and a table 2.
[0025]
[A table 1]

表1

		実施例1	実施例2	実施例3	実施例4
ガラス組成（重量%）	SiO_2	35.0	38.0	32.0	36.0
	B_2O_3	3.0	3.0	8.0	3.0
	Al_2O_3	3.0	3.0	3.0	3.0
	BaO	27.0	32.0	30.0	32.0
	SrO	14.0	12.0	5.0	3.0
	CaO	6.5	0.0	2.0	10.0
	MgO	2.0	3.0	0.0	3.0
	La_2O_3	4.0	5.0	10.0	5.0
	ZrO_2	5.0	4.0	3.0	5.0
	TiO_2	0.0	0.0	0.0	0.0
	ZrO_2+TiO_2	5.0	4.0	3.0	5.0
	ZnO	0.0	0.0	7.0	0.0
	Sb_2O_3	0.5	0.0	0.0	0.0
特性	熱膨張係数 ($\times 10^{-7}/℃$)	87	80	82	84
	ガラス転移点(℃)	695	685	655	675
	面粗度(Ra) (nm)	<10	<10	<10	<10

[0026]
[A table 2]

表2

		実施例5	実施例6	実施例7
ガラス組成(重量%)	SiO_2	43.0	37.0	39.0
	B_2O_3	4.0	3.0	2.0
	Al_2O_3	5.0	2.0	4.0
	BaO	33.0	30.0	31.0
	SrO	10.0	5.0	8.0
	CaO	6.0	8.0	4.0
	MgO	0.0	3.5	2.0
	La_2O_3	0.0	5.0	4.0
	ZrO_2	0.0	3.0	2.0
	TiO_2	0.0	2.0	2.0
	ZrO_2+TiO_2	0.0	5.0	4.0
	ZnO	0.0	1.0	2.0
	Sb_2O_3	0.0	0.5	0.0
特性	熱膨張係数 ($\times 10^{-7}$/℃)	82	84	81
	ガラス転移点(℃)	670	730	740
	面粗度(Ra) (nm)	<10	<10	<10

[0027] The glass of the presentation shown in the example 1 of a comparison and two table 3 was fused, the glass substrate was produced like examples 1-7, and a coefficient of thermal expansion, a glass transition point, and field relative roughness (Ra) were measured. The result is shown in a table 3.
[0028] The coefficient of thermal expansion, the glass transition point, and field relative roughness (Ra) of the example 3 of a comparison, the alumina ceramic substrate (example 3 of a comparison) of 4 marketing, and a commercial glass-epoxy resin substrate (example 4 of a comparison) were measured like examples 1-7. The result is shown in a table 3.
[0029]
[A table 3]

表3

		比較例1	比較例2	比較例3	比較例4
ガラス組成(重量%)	SiO_2	52.8	65.0	アルミナセラミック	ガラスーエポキシ樹脂
	B_2O_3	6.7	18.0		
	Al_2O_3	22.0	8.4		
	BaO	0.0	3.1		
	SrO	0.0	0.0		
	CaO	0.0	5.5		
	MgO	14.7	0.0		
	La_2O_3	0.0	0.0		
	ZrO_2	0.0	0.0		
	ZnO	2.5	0.0		
	Sb_2O_3	1.3	0.0		
特性	熱膨張係数 ($\times 10^{-7}$/℃)	34	45	70	150
	ガラス転移点(℃)	760	480	—	<250
	面粗度(Ra) (nm)	<10	<10	700	200

[0030] As shown in tables 1 and 2, a coefficient of thermal expansion is 80 - 90x10-7/degree C, and the field relative roughness (Ra) of each glass substrate of examples 1-7 is less than 10nm. As shown in a table 3 on the other hand, the glass substrate of the

examples 1 and 2 of a comparison has a coefficient of thermal expansion as low as 30 - 50x10-7/degree C. Each of alumina ceramic substrates of the examples 3 and 4 of a comparison and glass-epoxy resin substrates has still larger field granularity. Moreover, a glass-epoxy resin substrate has a large coefficient of thermal expansion the top where a glass transition point is low.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the front view of one example of IC chip mounting substrate currently laid in the mother board.
[Description of Notations]
1 Mother Board
2 Wiring Substrate
3 IC Chip
4 Solder Bump
5 Wiring Formation Section

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
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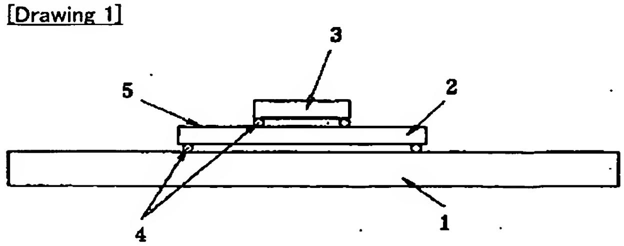
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Translation done.]

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(54)【発明の名称】配線基板材料

(57)【要約】

【課題】　平坦性、平滑性、電気絶縁性、加工性および化学的耐久性に優れると共に、適切な熱膨張係数を有し、半導体実装用配線基板などに有用な配線基板材料を提供する。

【解決手段】　重量％で、SiO_2　３０～５０％、B_2O_3　１～１０％、Al_2O_3　１～１０％、ＢａＯ　２０～５０％、ＳｒＯ　０～２０％、ＭｇＯ　０～５％およびＣａＯ　０～１５％を含有し、かつアルカリ成分を含まないガラスからなる配線基板材料である。

【特許請求の範囲】
【請求項1】　重量%で、SiO_2　30～50%、B_2O_3　1～10%、Al_2O_3　1～10%、BaO　20～50%、SrO　0～20%、MgO0～5%およびCaO　0～15%を含有し、かつアルカリ成分を含まないガラスからなる配線基板材料。
【請求項2】　さらに、他の成分として、ZnO、TiO_2、ZrO_2、Nb_2O_5、Sb_2O_3、SnO_2、La_2O_3、Bi_2O_3、Y_2O_3およびFの中から選ばれる少なくとも1種を含有する請求項1に記載の配線基板材料。
【請求項3】　重量%で、SiO_2　30～45%、B_2O_3　1～10%、Al_2O_3　1～7%、BaO　22～35%、SrO　1～17%、MgO　0～5%、CaO　0～14%、ZnO　0～15%、TiO_2　0～10%、ZrO_2　0～10%およびLa_2O_3　0～10%を含有し、かつアルカリ成分を含まないガラスからなる請求項2に記載の配線基板材料。
【請求項4】　重量%で、SiO_2　35～40%、B_2O_3　1～5%、Al_2O_3　1～5%、BaO　25～35%、SrO　1～10%、MgO　0～5%、CaO　1～10%、ZnO　0～15%、TiO_2　0～7%、$ZrO_2$0～7%およびLa_2O_3　1～7%を含有し、かつTiO_2とZrO_2の合計含有量が1～7%であって、アルカリ成分を含まないガラスからなる請求項3に記載の配線基板材料。
【請求項5】　熱膨張係数が70～100×10^{-7}/℃である請求項1～4のいずれか1項に記載の配線基板材料。
【発明の詳細な説明】
【0001】
【発明の属する技術分野】本発明は配線基板材料に関し、さらに詳しくは、平坦性、平滑性、電気絶縁性、加工性および化学的耐久性に優れると共に、適切な熱膨張係数を有し、半導体実装用配線基板などに有用な配線基板材料に関するものである。
【0002】
【従来の技術】ICやLSIなどの半導体チップを搭載する半導体実装用基板としては、種々のものが提案され、実用化されており、例えばガラス－エポキシ樹脂プリント基板で代表される樹脂基板やセラミックス基板などが実用化されている。近年、実装されるICチップの高密度化、高速化に伴い、基板材料に対する要求も厳しくなってきており、特に基板の平坦性、平滑性に対する要求が高い。基板表面の凹凸が大きいと狭ピッチの配線を均質に施せない上、ICチップを実装する際に突起が邪魔してチップが全面でボンディングできないなどの問題が生じる。これはフリップチップパッケージにとって致命的な欠陥となる。
【0003】図1は、マザーボードに載置されているICチップ実装基板の1例の正面図である。この図1で示すように、マザーボード1上に配線が形成された基板（配線基板）2が載置され、はんだバンプ4によって固定されている。そして、配線基板2に設けられた配線とICチップ3とがはんだバンプ4によって接続され、ICチップ3が実装される。なお、5は配線形成部である。
【0004】前記セラミックス基板は、面粗度や反りが大きく、使用上の制約が大きい上、研磨するにはコストがかかりすぎ、さらに熱膨張特性の整合性も重要な問題である。一方、一般的に使用されるガラス－エポキシ樹脂プリント基板は、熱膨張係数が150～160×10^{-7}/℃程度であり、この基板に熱膨張係数約34×10^{-7}/℃のシリコン結晶からなるICチップを実装しようとしても、実装後チップに歪みが残留したり、ボンディング部に亀裂が入ったり、さらにはICチップが破壊されたり、ボンディングが外れて接続不良を引き起こすなど、好ましくない事態を招来するおそれがある。したがって、半導体を実装した後マザーボードにはんだ付けされる配線基板は、半導体とマザーボードの熱膨張特性の差を緩和する役目をもたせるため、シリコン結晶とガラス－エポキシ樹脂基板の中間の熱膨張係数、すなわち70～100×10^{-7}/℃程度の熱膨張係数をもつ材料からなるものが好ましい。
【0005】
【発明が解決しようとする課題】本発明は、このような事情のもとで、平坦性、平滑性、電気絶縁性、加工性および化学的耐久性に優れると共に、適切な熱膨張係数を有し、半導体実装用配線基板などに有用な配線基板材料を提供することを目的とするものである。
【0006】
【課題を解決するための手段】本発明者は、前記の好ましい性質を有する配線基板材料を開発すべく鋭意研究を重ねた結果、特定の組成を有するガラスからなる配線基板材料が、その目的に適合しうることを見出し、この知見に基づいて本発明を完成するに至った。
【0007】すなわち、本発明は、重量%で、SiO_2　30～50%、B_2O_3　1～10%、Al_2O_3　1～10%、BaO　20～50%、SrO　0～20%、MgO　0～5%およびCaO　0～15%を含有し、かつアルカリ成分を含まないガラスからなる配線基板材料、および、さらに他の成分として、ZnO、TiO_2、ZrO_2、Nb_2O_5、Sb_2O_3、SnO_2、La_2O_3、Bi_2O_3、Y_2O_3およびFの中から選ばれる少なくとも1種を含有し、かつアルカリ成分を含まないガラスからなる配線基板材料を提供するものである。
【0008】
【発明の実施の形態】本発明の配線基板材料に用いられるガラスは、シリコン結晶とガラス－エポキシ樹脂基板の中間の熱膨張特性を持つ無アルカリガラスである。シリコン結晶とガラス－エポキシ樹脂基板の中間の熱膨張

特性をもつガラスは、７０～１００×10^{-7}／℃程度の熱膨張係数を有するものであって、このようなガラスとしては、ソーダライムガラスに代表されるようなアルカリを含むガラスが一般的である。しかしながら、アルカリ成分を含んでいるとガラス基板からアルカリ成分が溶出して半導体チップに損傷を与えるおそれがある。したがって、本発明の配線基板材料には、無アルカリガラスが用いられ、しかも該ガラスは、転移点が高く、配線基板の製造プロセスにおけるメッキ、蒸着、スパッタリング、はんだ付けなどの高温処理で変形しにくいものが要求される。

【０００９】ところが、無アルカリガラスは、一般的に、薄膜トランジスタ（ＴＦＴ）液晶ディスプレイパネル用ガラスに代表されるように低熱膨張であることが知られており、その上アルカリ成分は溶融温度を下げたり、液相温度を下げる効果があるため、ガラスの溶融を容易にする成分でもある。

【００１０】本発明で用いるガラスは、高熱膨張係数および高転移点を有し、しかも溶融が容易な無アルカリガラスである。本発明で用いるガラスにおいては、SiO_2はガラスの骨格をなすための必須成分である。そのためSiO_2が３０重量％未満になるとガラスの液相温度が上昇する。またSiO_2が５０重量％を超えると熱膨張係数が小さくなる。したがって、SiO_2の含有量は３０～５０重量％に限定される。好ましいSiO_2の含有量は３０～４５重量％であり、さらに好ましい含有量は３５～４０重量％である。

【００１１】B_2O_3は珪酸塩ガラスに添加することにより液相温度を下げる効果がある必須成分である。そのためB_2O_3が１重量％未満になると液相温度が上昇し、ガラス化しにくくなる。また１０重量％を超えると熱膨張係数が小さくなる。したがって、B_2O_3の含有量は１～１０重量％に限定される。好ましいB_2O_3の含有量は１～５重量％の範囲である。

【００１２】Al_2O_3はガラスの化学的耐久性を向上させる効果と、液相温度を下げる効果を有し、本発明には欠かせない成分である。そのためAl_2O_3が１重量％未満になると化学的耐久性が悪化し、液相温度が上昇する。また１０重量％を超えると、熱膨張係数が小さくなる。したがってAl_2O_3の含有量は１～１０重量％に限定される。好ましいAl_2O_3の含有量は１～７重量％であり、さらに好ましい含有量は１～５重量％である。

【００１３】ＢａＯは適量添加によりガラスの液相温度を下げる効果を有し、本発明には欠かせない成分である。ＢａＯが２０重量％未満または５０重量％を超える場合は液相温度が上昇する。したがって、ＢａＯの含有量は２０～５０重量％に限定される。好ましいＢａＯの含有量は２２～３５重量％であり、さらに好ましい含有量は２５～３５重量％である。

【００１４】ＳｒＯは適量添加によりガラスの液相温度

を下げる効果を有する任意成分である。ＳｒＯが２０重量％を超えた場合は液相温度が上昇する。したがって、ＳｒＯの含有量は０～２０重量％に限定される。好ましいＳｒＯの含有量は１～１７重量％であり、さらに好ましい含有量は１～１０重量％である。

【００１５】ＭｇＯ、ＣａＯは適量添加によりガラスの液相温度を下げ熱膨張係数を下げる効果を有し、本発明において任意の添加成分である。ＭｇＯが５重量％を、ＣａＯが１５重量％を超えると液相温度が上昇する。したがって、ＭｇＯの含有量は０～５重量％、ＣａＯの含有量は０～１５重量％に限定される。好ましいＣａＯの含有量は１～１４重量％であり、さらに好ましい含有量は１～１０重量％である。

【００１６】本発明で用いるガラスにおいては、さらに他の成分として、ＺｎＯ、TiO_2、ZrO_2、Nb_2O_5、Sb_2O_3、SnO_2、La_2O_3、Bi_2O_3、Y_2O_3、P_2O_5およびＦの中から選ばれる少なくとも１種を、液相温度の低下、化学的耐久性の向上、清澄、熱膨張係数の調整などのために、本発明の目的が損なわれない範囲で添加してもよい。これらの成分の中で、特にＺｎＯ、TiO_2、ZrO_2、La_2O_3が好適である。

【００１７】ＺｎＯは、液相温度を下げ、化学的耐久性を向上させる成分であり、任意に添加することができる。しかし、ＺｎＯが１５重量％を超えると熱膨張係数が低くなりすぎる。したがって、ＺｎＯの含有量は０～１５重量％に限定される。

【００１８】TiO_2、ZrO_2は、化学的耐久性を向上させる効果を有し、任意に添加することができる。しかし、TiO_2またはZrO_2の含有量が１０重量％を超えると耐失透性が悪化する。したがってTiO_2、ZrO_2の含有量は、それぞれ０～１０重量％に限定される。好ましいTiO_2、ZrO_2の含有量は、それぞれ０～７重量％である。また、TiO_2とZrO_2の合計含有量が１重量％未満では化学的耐久性の向上効果が十分に発揮されないし、７重量％を超えると失透しやすくなる。したがって、TiO_2とZrO_2の合計含有量は１～７重量％が好ましい。

【００１９】La_2O_3は液相温度を下げる効果を有し、任意に添加することができる。しかし、La_2O_3の含有量が１０重量％を超えると逆に液相温度が上昇する。したがって、La_2O_3の含有量は０～１０重量％に限定される。好ましいLa_2O_3の含有量は１～７重量％である。

【００２０】以上説明したように、本発明で用いるガラスの好ましいものは、重量％で、SiO_2　３０～４５％、B_2O_3　１～１０％、Al_2O_3　１～７％、ＢａＯ　２２～３５％、ＳｒＯ　１～１７％、ＭｇＯ　０～５％、ＣａＯ　１～１４％、ＺｎＯ　０～１５％、TiO_2　０～１０％、ZrO_2　０～１０％およびLa_2O_3 ０～１０％を含有する無アルカリガラスであり、さらに好

ましいものは、重量％で、SiO_2　３５～４０％、B_2O_3　１～５％、Al_2O_3　１～５％、ＢａＯ　２５～３５％、ＳｒＯ　１～１０％、ＭｇＯ　０～５％、ＣａＯ　１～１０％、ＺｎＯ　０～１５％、TiO_2　０～７％、ZrO_2　０～７％およびLa_2O_3　１～７％を含有し、かつTiO_2とZrO_2の合計含有量が１～７％の無アルカリガラスである。

【００２１】このような組成のガラスからなる配線基板材料は、平坦性、平滑性、電気絶縁性、化学的耐久性に優れ、かつ溶融温度が低くて加工性も良好である上、７０～１００×10^{-7}／℃程度の熱膨張係数を有している。本発明の配線基板材料となるガラスの作製方法としては特に制限はなく、従来慣用されている方法を用いることができる。例えば、ガラス原料として水酸化物、炭酸塩、硝酸塩、酸化物、硫化物、塩化物などを適宜用い、所望の組成になるように秤量し、混合して調合原料とする。これを耐熱坩堝に入れ１２００～１５００℃程度の温度で溶融し、攪拌、清澄した後、所望形状の鋳型に流し込み、徐冷することにより、均質なガラスが得られる。

【００２２】ガラス加工方法も特に制限はなく、従来慣用されている方法を用いることができる。例えば、得られたガラスブロックをスライスして薄板状にした後、両面をラッピングまたはポリシングすることによって平坦性に優れた基板を作製することができる。この基板にメッキ、蒸着、スパッタリング、エッチング、フォトリソグラフィーなどの手法を用いて配線を形成することにより半導体実装用の配線基板となる。またガラス基板にエッチング、サンドブラスト、超音波加工、レーザー加工などの方法で穴をあけ、そこに金属を埋め込み、ボンディングパッドや配線を形成することによって多層配線基板あるいはビアホールをもった単相配線基板を作製することもできる。

【００２３】

【実施例】次に、本発明を実施例により、さらに詳細に説明するが、本発明は、これらの例によってなんら限定されるものではない。

【００２４】実施例１～７

表１および表２に示す組成のガラスを溶融し鉄枠中に鋳込み成形し、室温まで徐冷することによりガラスブロックを作製した。得られたガラスブロックを切断、スライス、研磨を経て１００×１００×１．０mmの板状に加工した。このガラス基板の熱膨張係数、ガラス転移点および面粗度（Ｒａ）を測定した。なお、熱膨張係数、ガラス転移点は日本光学硝子工業会規格ＪＯＧＩＳ－１９７５に基づき測定すると共に、面粗度は接触式表面粗さ計で測定した。結果を表１および表２に示す。

【００２５】

【表１】

表１

		実施例１	実施例２	実施例３	実施例４
ガラス組成（重量％）	SiO_2	３５．０	３８．０	３２．０	３６．０
	B_2O_3	３．０	３．０	８．０	３．０
	Al_2O_3	３．０	３．０	３．０	３．０
	ＢａＯ	２７．０	３２．０	３０．０	３２．０
	ＳｒＯ	１４．０	１２．０	５．０	３．０
	ＣａＯ	６．５	０．０	２．０	１０．０
	ＭｇＯ	２．０	３．０	０．０	３．０
	La_2O_3	４．０	５．０	１０．０	５．０
	ZrO_2	５．０	４．０	３．０	５．０
	TiO_2	０．０	０．０	０．０	０．０
	ZrO_2+TiO_2	５．０	４．０	３．０	５．０
	ＺｎＯ	０．０	０．０	７．０	０．０
	Sb_2O_3	０．５	０．０	０．０	０．０
特性	熱膨張係数（$\times10^{-7}$/℃）	８７	８０	８２	８４
	ガラス転移点(℃)	６９５	６８５	６５５	６７５
	面粗度(Ra) (nm)	＜１０	＜１０	＜１０	＜１０

【００２６】

【表２】

表２

		実施例５	実施例６	実施例７
ガラス組成（重量％）	SiO_2	４３．０	３７．０	３９．０
	B_2O_3	４．０	３．０	２．０
	Al_2O_3	５．０	２．０	４．０
	BaO	３３．０	３０．０	３１．０
	SrO	１０．０	５．０	８．０
	CaO	６．０	８．０	４．０
	MgO	０．０	３．５	２．０
	La_2O_3	０．０	５．０	４．０
	ZrO_2	０．０	３．０	２．０
	TiO_2	０．０	２．０	２．０
	ZrO_2+TiO_2	０．０	５．０	４．０
	ZnO	０．０	１．０	２．０
	Sb_2O_3	０．０	０．５	０．０
特性	熱膨張係数 ($\times10^{-7}$/℃)	８２	８４	８１
	ガラス転移点(℃)	６７０	７３０	７４０
	面粗度(Ra) (nm)	＜１０	＜１０	＜１０

【００２７】比較例１、２
表３に示す組成のガラスを溶融し、実施例１〜７と同様にしてガラス基板を作製し、熱膨張係数、ガラス転移点および面粗度（Ｒａ）を測定した。その結果を表３に示す。

【００２８】比較例３、４
市販のアルミナセラミック基板（比較例３）および市販のガラス−エポキシ樹脂基板（比較例４）の熱膨張係数、ガラス転移点および面粗度（Ｒａ）を、実施例１〜７と同様にして測定した。その結果を表３に示す。

【００２９】

【表３】

表３

		比較例１	比較例２	比較例３	比較例４
ガラス組成（重量％）	SiO_2	５２．８	６５．０	アルミナセラミック	ガラス−エポキシ樹脂
	B_2O_3	６．７	１８．０		
	Al_2O_3	２２．０	８．４		
	BaO	０．０	３．１		
	SrO	０．０	０．０		
	CaO	０．０	５．５		
	MgO	１４．７	０．０		
	La_2O_3	０．０	０．０		
	ZrO_2	０．０	０．０		
	ZnO	２．５	０．０		
	Sb_2O_3	１．３	０．０		
特性	熱膨張係数 ($\times10^{-7}$/℃)	３４	４５	７０	１５０
	ガラス転移点(℃)	７６０	４８０	—	＜２５０
	面粗度(Ra) (nm)	＜１０	＜１０	７００	２００

【００３０】表１、２から分かるように、実施例１〜７のガラス基板はいずれも熱膨張係数が８０〜９０×１０$^{-7}$／℃であり面粗度（Ｒａ）が１０ｎｍ未満である。一方、表３から分かるように、比較例１、２のガラス基板

は熱膨張係数が３０～５０×１０$^{-7}$／℃と低い。さらに比較例３、４のアルミナセラミック基板、ガラス－エポキシ樹脂基板は、いずれも面粗さが大きい。またガラス－エポキシ樹脂基板はガラス転移点が低い上、熱膨張係数が大きい。

【００３１】

【発明の効果】本発明の配線基板材料は、平坦性、平滑性、電気絶縁性、加工性および化学的耐久性に優れると共に、熱膨張係数が７０～１００×１０$^{-7}$／℃程度であり、半導体実装用配線基板などに有用である。

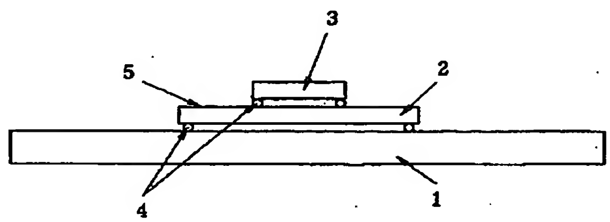
【図面の簡単な説明】

【図１】マザーボードに載置されているＩＣチップ実装基板の１例の正面図である。

【符号の説明】

１　マザーボード
２　配線基板
３　ＩＣチップ
４　はんだバンプ
５　配線形成部

【図１】



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